

# Caribbean Amphipoda (Crustacea) of Panama. Part III: parvorder Lysianassidira

Kristine N. White<sup>1</sup> 

<sup>1</sup> Aquatic Sciences Center, Department of Biological and Environmental Sciences, Georgia College & State University, Milledgeville, GA 31061, USA  
Corresponding author: Kristine N. White ([kristine.white@gcsu.edu](mailto:kristine.white@gcsu.edu))

## Abstract

Amphipods in the parvorder Lysianassidira are scavengers, often collected in sediment, coral rubble, algae, or among other invertebrates. Members of the parvorder have a head that is deeper than long, large coxae, lacinia mobilis present only on the left molar, and a mitten-shaped gnathopod 2 propodus with a long ischium. Nine species from two families within the parvorder are documented from Bocas del Toro, Panama. This research documents range extensions for eight species and an identification key to the species of Caribbean Lysianassidira of Panama is provided.

## Resumen

Los anfípodos del parvorden Lysianassidira son carroñeros, a menudo recolectados en sedimentos, escombros de coral, algas o entre otros invertebrados. Los miembros del parvorden tienen una cabeza que es más profunda que larga, con coxas grandes, lacinia mobilis presenta solo en el molar izquierdo y un gnatópodo 2 en forma de manopla con un isquion largo. Nueve especies de dos familias dentro del parvorden están documentadas en Bocas del Toro, Panamá. Esta investigación documenta extensiones de rango para ocho especies y se proporciona una clave de identificación para las especies de Lysianassidira caribeña de Panamá.

**Key words:** Bocas del Toro, identification key, Lysianassidae, Lysianassoidea, Tryphosidae



This article is part of:  
**Caribbean Amphipoda of Panama**  
Edited by Kristine N. White

Academic editor: Alan Myers  
Received: 21 August 2024  
Accepted: 4 October 2024  
Published: 24 October 2024

ZooBank: <https://zoobank.org/67B6C273-62C5-4F89-AE63-316B73D65D55>

Citation: White KN (2024) Caribbean Amphipoda (Crustacea) of Panama. Part III: parvorder Lysianassidira. ZooKeys 1216: 149–171. <https://doi.org/10.3897/zookeys.1216.135258>

Copyright: © Kristine N. White.  
This is an open access article distributed under terms of the Creative Commons Attribution License ([Attribution 4.0 International – CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)).

## Introduction

Parvorder Lysianassidira Dana, 1849 is comprised of 1243 species around the world, with several listed as *incertae sedis* (Horton et al. 2024). Members of the parvorder are characterized by having the head that is deeper than long, antenna 1 with callynophore, large coxae, lacinia mobilis present only on the left molar, and a distally mitten-shaped gnathopod 2 propodus with a long ischium (Lowry and Myers 2017). The parvorder contains 33 families of amphipods: Alicellidae Lowry & DeBroyer, 2008 (17 spp.), Parargissidae Lowry & Myers, 2017 (two spp.), Podoprionidae Lowry & Stoddart, 1996 (four spp.), Valettidae Stebbing, 1888 (two spp.), Valettiopsidae Lowry & DeBroyer, 2008 (12 spp.), Vemaniidae Lowry & Myers, 2017 (five spp.), Stegocephalidae Dana, 1852 (110 spp.), Adeliellidae Lowry & Myers, 2017 (three spp.), Amaryllididae Lowry & Stoddart,



2002 (37 spp.), Cebocaridae Lowry & Stoddart, 2011 (15 spp.), Cyclocaridae Lowry & Stoddart, 2011 (four spp.), Cyphocarididae Lowry & Stoddart, 1997 (21 spp.), Eurytheneidae Stoddart & Lowry, 2004 (10 spp.), Hirondelleidae Lowry & Stoddart, 2010a (20 spp.), Lysianassidae Dana, 1849 (130 spp.), Opisidae Lowry & Stoddart, 1995 (19 spp.), Scopelocheiridae Lowry & Stoddart, 1997 (27 spp.), Tryphosidae Lowry & Stoddart, 1997 (389 spp.), Uristidae Hurley, 1963 (190 spp.), Acidostomatidae Stoddart & Lowry, 2012 (11 spp.), Ambasiidae Lowry & Myers, 2017 (three spp.), Aristiidae Lowry & Stoddart, 1997 (42 spp.), Conicostomatidae Lowry & Stoddart, 2012 (19 spp.), Derjugianidae Lowry & Myers, 2017 (one sp.), Endevouridae Lowry & Stoddart, 1997 (19 spp.), Izinkalidae Lowry & Stoddart, 2010c (two spp.), Kergueleniidae Lowry & Stoddart, 2010d (26 spp.), Lepidepecreellidae Stoddart & Lowry, 2010 (12 spp.), Pakynidae Lowry & Myers, 2017 (38 spp.), Sophrosynidae Lowry & Stoddart, 2010b (14 spp.), Thoriellidae Lowry & Stoddart, 2011 (seven spp.), Trischizostomatidae Lilljeborg, 1865 (18 spp.), Wandinidae Lowry & Stoddart, 1990 (four spp.). Only 30 species in the parvorder have been previously reported from the Caribbean Sea, representing ten families (Aristiidae, Cyphocarididae, Endevouridae, Eurythenidae, Lysianassidae, Parargissidae, Stegocephalidae, Tryphosidae, Uristidae, Vemanidae). Four species, *Concarnes concavus* (Shoemaker, 1933), *Eclecticus eclecticus* Lowry & Stoddart, 1997, *Paracentromedon carabicus* Barnard, 1964, and *Vemana compressa* Barnard, 1964 have been previously reported from Caribbean Panama (LeCroy et al. 2009; Miloslavich et al. 2010; Martín et al. 2013). Miloslavich et al. (2010) listed *Parargissa galathea americana* Barnard, 1961 from Caribbean Panama without locality details, but Barnard (1961) stated that it was collected from the Pacific. Andres (1977) documented *P. galathea americana* from the eastern Atlantic, but the author can find no reports of this species from the Caribbean and, thus, do not include it herein.

Within the parvorder Lysianassidira, nine species of amphipods were collected from Bocas del Toro, Panama, with representatives from the families Lysianassidae and Tryphosidae. Regional diagnoses for each species collected during this study are provided herein. An identification key is provided to distinguish between the Lysianassidira species known from the Caribbean waters of Panama.

## Methods

Coral rubble, sand, algae, and sponges were collected by hand and placed into buckets or plastic bags from various sites around Bocas del Toro, Panama at depths of 0–15 m. Coral rubble, sand, and algae were elutriated with freshwater to remove amphipods, and sponges were sorted through by hand. Live amphipods were sorted to morphospecies, placed in clove oil for imaging, and preserved in 99.5% EtOH for later examination. Preserved specimens were transferred to glycerol, measured from the tip of the rostrum to the base of the telson, and dissected under a stereomicroscope. Specimens were illustrated using a Meiji MT5900L phase contrast microscope with an Olympus U-DA drawing tube. Illustrations were digitally inked following Coleman (2003) in Adobe Illustrator 2024 using a Wacom® Intuos Pro Pen Tablet. Abbreviations used in figures are as follows: Hd, head; Mx2, maxilla 2; G, gnathopod; P, pereopod; E, epimeron; Ur: urosome; U, uropod; T, telson. Size ranges of each species collected from Bocas del Toro, Panama are provided at the beginning of each



material examined section. Specimens are deposited in the Smithsonian Institution, U.S. National Museum of Natural History (**USNM**) and the Gulf Coast Research Laboratory Museum (**GCRL**).

## Results

**Parvorder Lysianassidira Dana, 1849**

**Superfamily Lysianassoidea Dana, 1849**

**Family Lysianassidae Dana, 1849**

**Genus *Aruga* Holmes, 1908**

**Diagnosis.** Antenna 1 with strong callynophore in male and female. Antenna 2 flagellum elongate in male. Epistome not produced; upper lip produced. Maxilla 2 inner plate narrow. Gnathopod 1 simple. Gnathopod 2 minutely chelate. Uropod 2 inner ramus with dorsal notch, gradually narrowing distally. Uropod 3 outer ramus 2-articulate. Telson entire.

***Aruga holmesi* J.L. Barnard, 1955**

Figs 1, 10A

*Aruga holmesi* J.L. Barnard, 1955: 100, pls 27, 28; J.L. Barnard 1958: 90; J.L. Barnard 1959: 18; Gurjanova 1962: 299–301, figs 98, 99; J.L. Barnard 1964: 79, chart 1; Barnard and Karaman 1991: 469; Lowry and Stoddart 1997: 47–53, figs 17–20; LeCroy 2007: 575, fig. 497.

*Lysianopsis holmesi*: Hurley 1963: 74, 75, fig. 21b.

*Lysianassa holmesi*: J.L. Barnard 1966a: 25; J.L. Barnard 1966b: 69; J.L. Barnard 1979: 12, 130; Austin 1985: 600; Stepien and Brusca 1985: 97–101, fig. 2F; Stretch 1985: 129–133.

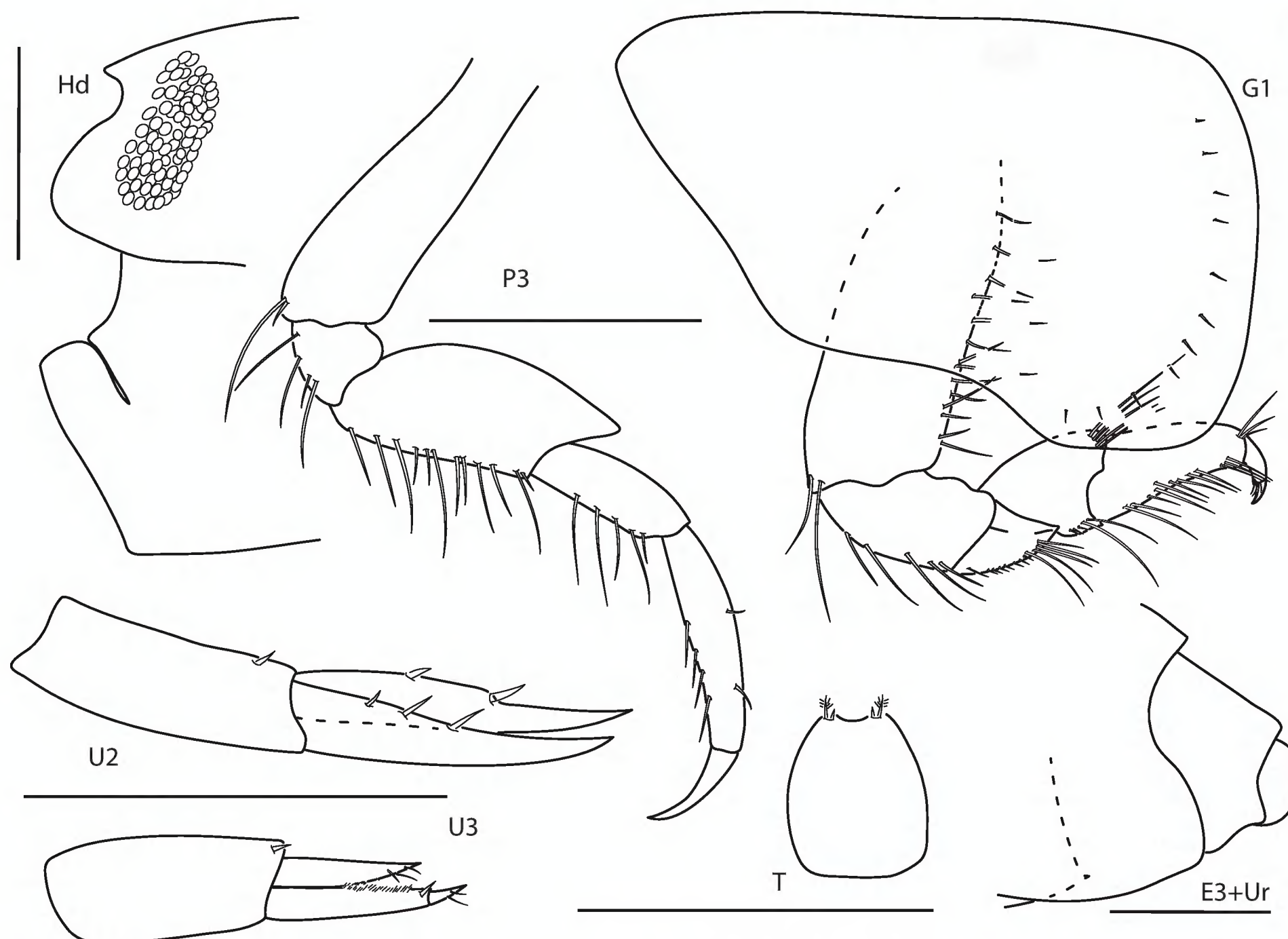
**Material examined.** PANAMA • 4.8 mm • 1 ♀; Bocas del Toro, Crawl Cay; 9.2376°N, 82.1438°W; depth 1.5–3 m, among coral rubble; 11 Aug 2021; K.N. White leg.; USNM 1739772.

**Diagnosis.** Upper lip projecting well beyond epistome; epistome concave. Gnathopod 1 propodus posterodistal margin slightly concave. Epimeron 3 posteroventral corner subquadrate, without tooth. Uropod 3 peduncle length at least 2 × width. Telson distal margin truncate, slightly emarginate, with two short setae on each side.

**Distribution.** USA: Folly Island, South Carolina; Florida from Perdido Key to the lower Florida Keys (LeCroy 2007); Pacific California (Lowry and Stoddart 1997); Ecuador (Lowry and Stoddart 1997); Panama: Pacific side of Isthmus of Panama (Lowry and Stoddart 1997); Bocas del Toro (present study).

**Ecology and remarks.** These amphipods are associated with coral rubble and seagrass beds at depths of 1.5–120 m. Panamanian specimens agree closely with previous descriptions of the species. Lowry and Stoddart (1997) recorded this species from the Gulf of Mexico for the first time, noting that it was previously only known from the Pacific side of the Isthmus of Panama. Panamanian specimens are white in color when alive.





**Figure 1.** *Aruga holmesi*, female, 4.8 mm, head, epistome and upper lip, pereopod 3, gnathopod 1 lateral, uropod 2, uropod 3, telson, epimeron 3 and urosome. Scale bars: 0.5 mm.

### Genus *Bonassa* Barnard & Karaman, 1991

**Diagnosis.** Antenna 1 with strong callynophore in male. Antenna 2 flagellum elongate in male. Epistome and upper lip produced. Maxilla 2 inner plate narrow. Gnathopod 1 simple. Gnathopod 2 minutely chelate. Uropod 2 inner ramus with dorsal notch, gradually narrowing distally. Uropod 3 outer ramus 1-articulate. Telson entire.

### *Bonassa bonairensis* (Stephensen, 1933)

Figs 2, 10B

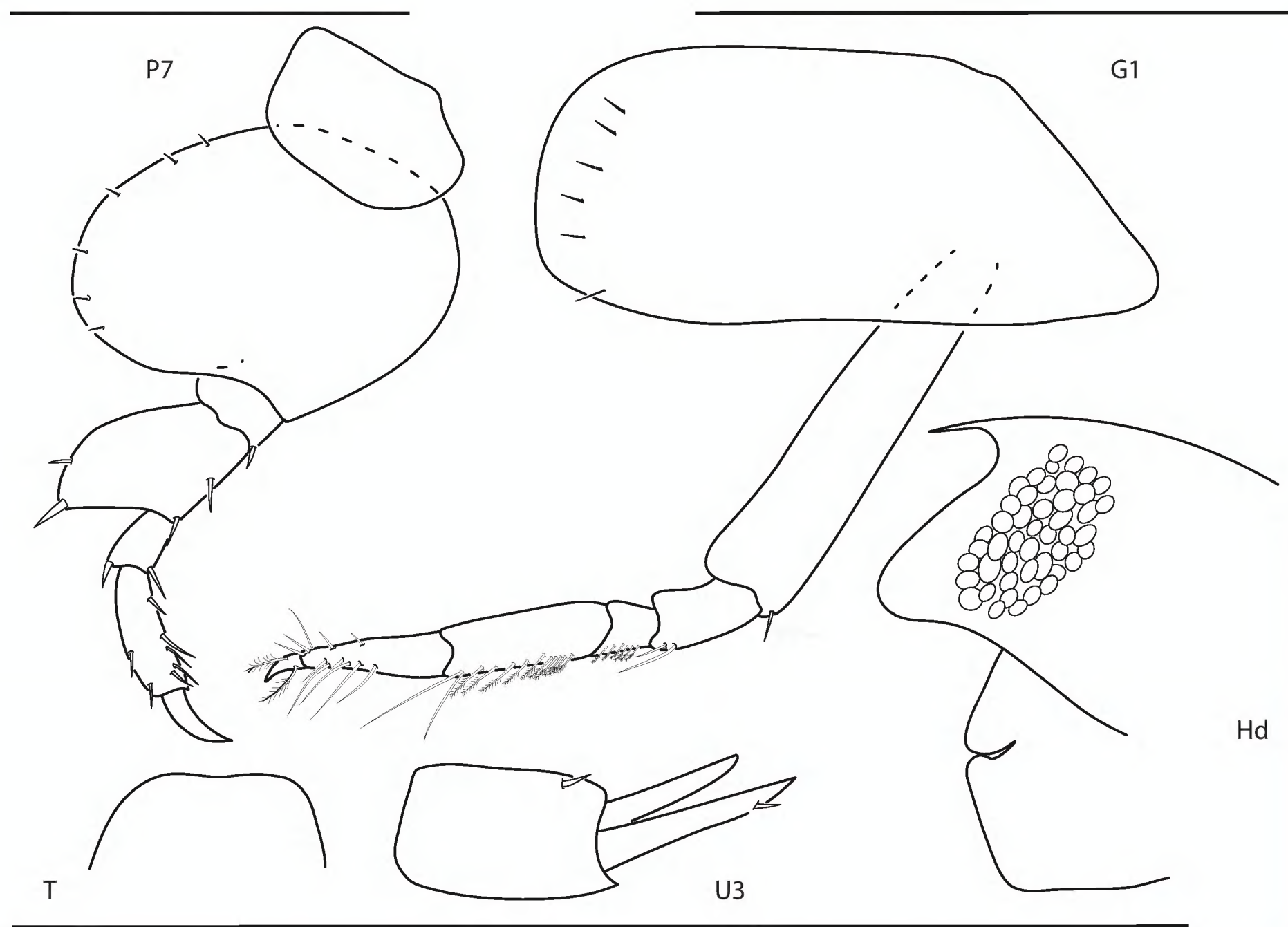
*Lysianassa* (?) *bonairensis* Stephensen, 1933a: 416–420, figs 1, 2; Stephensen 1948: 1, 3.

*Lysianassa bonairensis* J.L. Barnard, 1958: 94; Ortiz 1979: 19.

*Bonassa bonairensis* Barnard & Karaman, 1991: 472; Lowry and Stoddart 1997: 54–58, figs 21–23.

**Material examined.** PANAMA • 2–3 mm • 1 ♀; Bocas del Toro, Swan Cay; 9.4533°N, 82.2983°W; depth 2–3 m, among algae; 4 Aug 2005; S. DeGrave leg.; GCRL 6655 • 1 ♀; Bocas del Toro, Drago; 9.418056°N, 82.3375°W; depth 2–3 m, among coral rubble, 9 Aug 2021; K.N. White leg.; USNM 1739773 • 1 juvenile;





**Figure 2.** *Bonassa bonairensis*, female, 2.8 mm, pereopod 7, gnathopod 1 lateral, telson, uropod 3, head, epistome and upper lip. Scale bars: 0.5 mm.

Bocas del Toro, Hospital Point; 9.331967°N, 82.214817°W; depth 1–3 m, among coral rubble; 22 June 2023; K.N. White leg.; USNM 1739774.

**Diagnosis.** Epistome produced, rounded, subequal to produced upper lip. Antenna 1 with strong callynophore in female. Gnathopod 1 propodus distally narrowing. Pereopod 7 basis greatly expanded, posteriorly rounded; merus greatly expanded, approximately 3 × width of carpus. Uropod 3 rami narrow, apically acute, and lacking plumose setae in female. Telson distal margin truncate, slightly emarginate.

**Distribution.** Lesser Antilles: Bonaire Island (Stephensen 1933a; Lowry and Stoddart 1997); Panama: Bocas del Toro (present study).

**Ecology and remarks.** These amphipods occur among algae and coral rubble at depths of 1–3 m. Panamanian specimens agree closely with previous descriptions of the species, with the exception of a slightly emarginate telson, with the exception of the uropod 3, which is documented for the first time in a female. This species is easily distinguishable based on the expanded pereopod 7 basis and merus. Panamanian specimens are a translucent white color when alive.

### Genus *Concarnes* Barnard & Karaman, 1991

**Diagnosis.** Antenna 1 with strong callynophore in male, lacking in female. Antenna 2 flagellum short in male and female. Epistome and upper lip produced.



Mouthparts forming quadrate bundle. Maxilla 2 inner plate broad. Gnathopod 1 simple. Uropod 2 inner ramus with dorsal notch, gradually narrowing distally. Uropod 3 outer ramus 2-articulate. Telson weakly cleft.

***Concarnes concavus* (Shoemaker, 1933)**

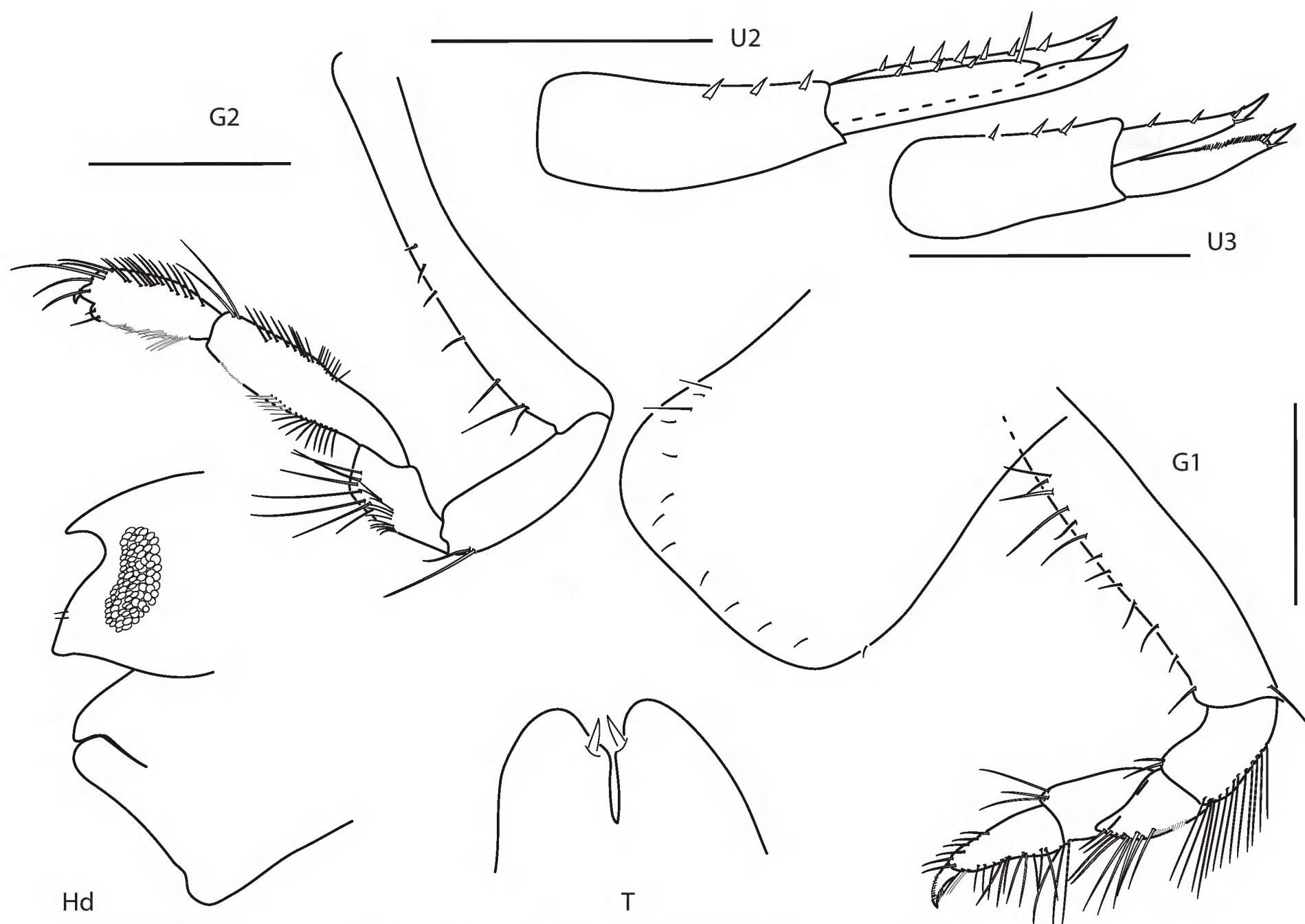
Figs 3, 10C

*Socarnes concavus* Shoemaker, 1933: 247–248, fig. 1; J.L. Barnard 1958: 99; Gurjanova 1962: 304; Ortiz 1979: 19.

*Concarnes concavus* Barnard & Karaman, 1991: 477; Lowry and Stoddart 1997: 58–63, figs 24–26; LeCroy 2007: 576, fig. 493.

**Material examined.** PANAMA • 5–6 mm • 1 ♀; Bocas del Toro, Crawl Cay; 9.2475°N, 82.1290°W; depth 5 m, among coral rubble; 12 Aug 2021; K.N. White leg.; USNM 1739775 • 1 ♀; Bocas del Toro, Crawl Cay; 9.2460°N, 82.1369°W; depth 1–4 m, among coral rubble; 25 June 2023; K.N. White leg.; USNM 1739776.

**Diagnosis.** Head ocular lobe subacute. Epistome produced, rounded, subequal to produced upper lip. Gnathopod 1 basis slender, elongate; propodus distally narrowing. Gnathopod 2 minutely subchelate. Telson partially cleft, lobes apically rounded.



**Figure 3.** *Concarnes concavus*, female, 6.0 mm, gnathopod 2 lateral, uropod 2, uropod 3, head, epistome, and upper lip, telson, gnathopod 1 medial. Scale bars: 0.5 mm.



**Distribution.** USA: Santee River, South Carolina (LeCroy 2007); off Sapelo and Little Tybee Islands, Georgia (LeCroy 2007); Dry Tortugas (Shoemaker 1933); Gulf of Mexico from Florida Keys to Panama City (Thomas 1993; Lowry and Stoddart 1997; LeCroy 2007); Belize (Thomas 1993); Panama: Bocas del Toro (Miloslavich et al. 2010; present study).

**Ecology and remarks.** These amphipods are associated with coral rubble and coarse sand at depths of 1–80 m. Panamanian specimens agree closely with previous descriptions of the species. This species is easily recognizable by the subacute ocular lobe, produced epistome and upper lip, and slender, elongate basis of gnathopod 1. Panamanian specimens have a distinct red coloration on the tips of antennae and on the anterior half of the body and have a white snowflake pattern on the posterior half of the body when alive.

### Genus *Lysianopsis* Holmes, 1903

**Diagnosis.** Antenna 1 with strong callynophore in male, weak or lacking in female. Antenna 2 flagellum short in male and female. Epistome not produced; upper lip produced. Maxilla 2 inner plate narrow. Gnathopod 1 simple. Gnathopod 2 minutely chelate. Uropod 2 inner ramus with dorsal notch, gradually narrowing distally. Uropod 3 outer ramus 1-articulate. Telson entire.

#### *Lysianopsis hummelincki* (Stephensen, 1933)

Figs 4, 10D

*Lysianassa hummelincki* Stephensen, 1933b: 438–440, fig. 1; Pirlot 1936: 256; Stephensen 1948: 1, 3, table 1; J.L. Barnard 1958: 94; Hurley 1963: 72; Ortiz 1979: 19.

*Lysianassa falcata* Stephensen, 1933b: 440–441, fig. 2; Stephensen 1948: 1, 4, table 1; J.L. Barnard 1958: 94; Ortiz 1979: 19.

*Lysianopsis alba* Barnard & Karaman, 1991: 499 (in part).

*Falcanassa falcata* Barnard & Karaman, 1991: 486.

*Lysianopsis hummelincki* Lowry & Stoddart, 1997: 82–89, figs 37–39.

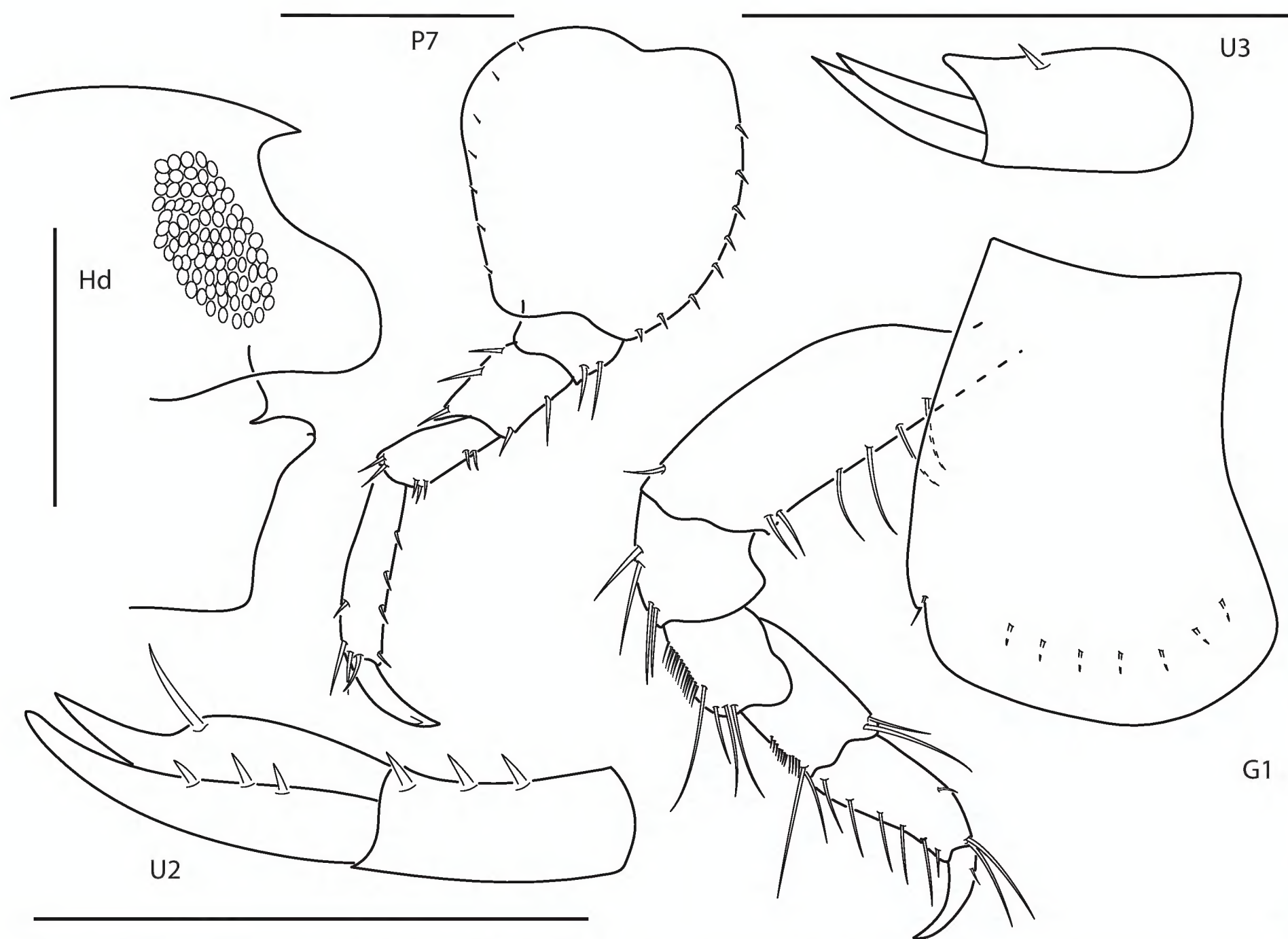
**Material examined.** PANAMA • 4 mm • 1 ♂; Bocas del Toro, Hospital Point; 9.3320°N, 82. 2148°W; depth 1–3 m, among coral rubble; 22 June 2023; K.N. White leg.; USNM 1739777.

**Diagnosis.** Upper lip produced well beyond epistome; epistome straight. Gnathopod 1 of male prehensile. Pereopod 7 basis slightly expanded, posterior margin almost straight, merus slightly expanded, approximately 1.4 × width of carpus. Uropod 3 peduncle length about 1.5 × width; outer ramus 1-articulate. Telson distal margin rounded.

**Distribution.** Lesser Antilles: Curaçao (Stephensen 1933b); Panama: Bocas del Toro (present study).

**Ecology and remarks.** These amphipods are associated with sand and coral rubble at depths of intertidal 0–12 m. Panamanian specimens agree closely with previous descriptions with the exception of the almost straight posterior margin on the pereopod 7 basis, which was described by Lowry and Stoddart





**Figure 4.** *Lysianopsis hummelincki*, male 4.0 mm, head, upper lip, and epistome, pereopod 7, gnathopod 1, uropod 2, uropod 3. Scale bars: 0.5 mm.

(1997) as slightly concave. This species is easily recognizable by the 1-articulate outer ramus on uropod 3 and the prehensile gnathopod 1 in males. Panamanian specimens are white with brown spots when alive.

#### ***Lysianopsis ozona* Lowry & Stoddart, 1997**

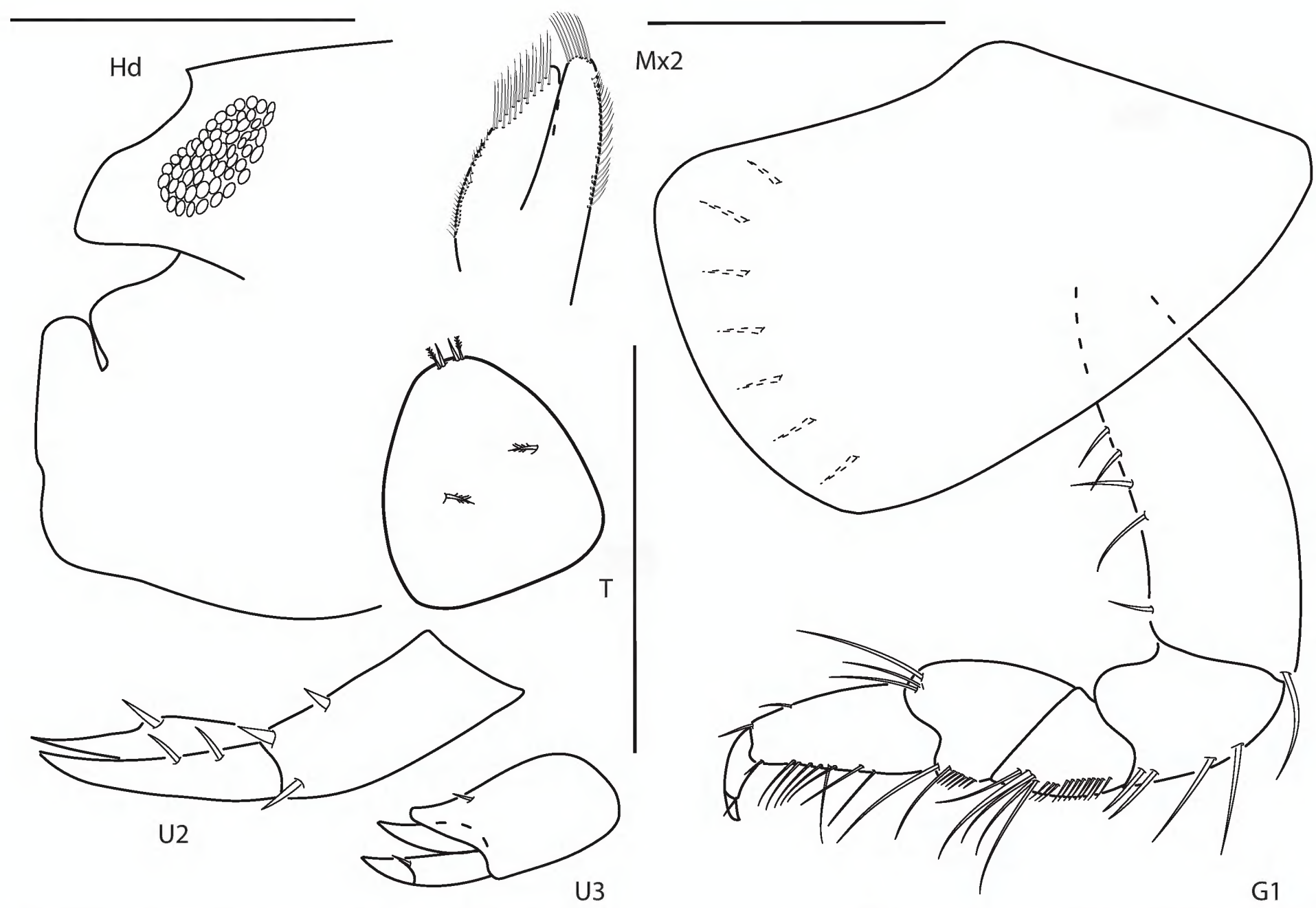
Figs 5, 10E

*Lysianopsis ozona* Lowry & Stoddart, 1997: 87–91, figs 40–42.

**Material examined.** PANAMA • 3.2–8.5 mm • 2 ♀; Bocas del Toro, Bastamientos; depth 0–1 m, mangrove scrapings; 1 Aug 2005; T.A. Haney leg.; GCRL 6656. • 2 ♂; Bocas del Toro, Hospital Bight; 9.3045°N, 82.3160°W; depth 1.5 m, among coral rubble; 7 Aug 2005; T.A. Haney leg.; GCRL 6657 • 1 ♀; Bocas del Toro, Marina Bocas; depth 0–1 m, associated with *Phallusia nigra* ascidian; 5 June 2009; R. Rocha leg.; GCRL 6658 • 1 ♂; Bocas del Toro, Isla Solarte; 9.2901°N, 82.1897°W; depth 1–5 m, associated with solitary ascidian; 8 Aug 2021; K.N. White leg.; USNM 1739778.

**Diagnosis.** Epistome concave, subequal to upper lip. Gnathopod 1 propodus posterodistal margin straight; not sexually dimorphic. Uropod 3 peduncle





**Figure 5.** *Lysianopsis ozona*, male, 3.2 mm, head, upper lip, and epistome, uropod 2, uropod 3, gnathopod 1 lateral; male, 6.5 mm, maxilla 2, telson. Scale bars: 0.5 mm.

length approximately  $1.5 \times$  width; outer ramus 2-articulate. Telson apical margin slightly truncate, apical margin with four short setae medially.

**Distribution.** USA: Eastern Gulf of Mexico (Lowry and Stoddart 1997); Panama: Bocas del Toro (present study).

**Ecology and remarks.** These amphipods are associated with sand, coral rubble, and various invertebrates at depths of 0–29 m. Panamanian specimens agree closely with the description provided by Lowry and Stoddart (1997). This species is easily recognizable by the concave epistome and the short uropod 3 peduncle and 2-articulate outer ramus. Panamanian specimens have an orange-brown coloration with white stripes along the pereonite edges when alive.

### Genus *Shoemakerella* Pirlet, 1936

**Diagnosis.** Antenna 1 with weak callynophore in male, lacking in female. Antenna 2 flagellum short in male and female. Epistome not produced; upper lip produced. Maxilla 2 inner plate wider than outer plate. Gnathopod 1 simple. Pereopods 3–4 merus not enlarged compared to carpus. Uropod 2 inner ramus with dorsal notch, abruptly narrowing distally. Uropod 3 outer ramus 1-articulate. Telson entire, dorsal setae inserted proximally (compared to other genera).



***Shoemakerella cubensis* (Stebbing, 1897)**

Figs 6, 11A

*Lysianax cubensis* Stebbing, 1897: 29–30, pl. 7B; Hurley 1963: 70–71, fig. 20 b, c; Lowry and Stoddart 1989: 236–237.

*Lysianassa cubensis* Stebbing, 1906: 38; Shoemaker 1935: 232–234, fig. 1.

*Lysianopsis alba* Pearse, 1912: 369, fig. 1 (in part); Shoemaker 1921: 99.

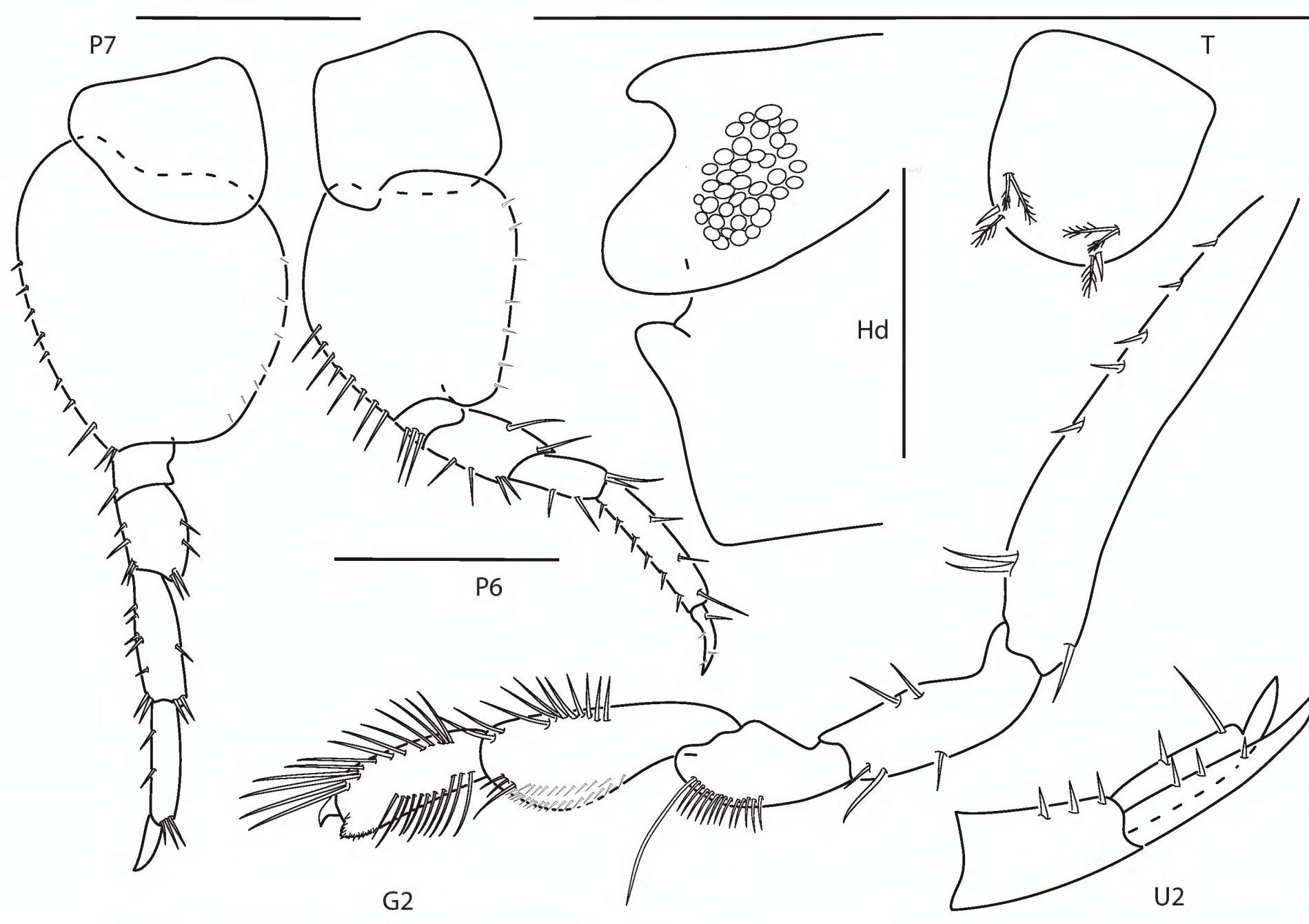
*Shoemakerella nasuta* Pirlot, 1936: 265–266; Pirlot 1939: 47–48; Shoemaker 1948: 1–2; J.L. Barnard 1969: 180; Ortiz and Lalana Rueda 1993: 26; Ortiz and Lemaitre 1994: 124.

*Lysianopsis cubensis* Hurley, 1963: fig. 21a.

*Lysianassa nasuta* Ortiz, 1978: 8; Ortiz 1979: 19; Lalana Rueda and Pérez Moreno 1985: 51; Lalana Rueda et al. 1989: 210; Lalana Rueda and Ortiz 1990: 196; Ortiz and Lalana Rueda 1992: 40.

*Shoemakerella cubensis* Barnard & Karaman, 1991: 530; Lowry and Stoddart 1997: 92–98, figs 43–45; LeCroy 2007: 588, fig. 495.

**Material examined.** PANAMA • 1.5–4 mm • 3 ♀, 1 juvenile; Bocas del Toro, Hospital Point; 9.3336°N, 82.2188°W; depth 15 m, among coral rubble and



**Figure 6.** *Shoemakerella cubensis*, male, 4.0 mm, pereopod 7, pereopod 6, head, epistome, and upper lip, telson, gnathopod 2 lateral, uropod 2. Scale bars: 0.5 mm.



*Halimeda*; 6 Aug 2005; S. DeGrave and M. Salazar leg.; GCRL 6659 • 2 ♂, 9 ♀, 11 juvenile; Bocas del Toro, Lime Point; 9.4149°N, 82.3323°W; depth 0.2–0.5 m, among coral rubble and red algae; 5 Aug 2005; S. DeGrave and M. Salazar leg.; GCRL 6660 • 1 juvenile; Bocas del Toro, Juan Point; 9.3015°N, 82.2940°W; depth 10 m, among coral rubble; 7 Aug 2021; K.N. White leg.; USNM 1739779 • 1 ♂, 2 juvenile; Bocas del Toro, Isla Solarte; 9.29011°N, 82.1897°W; depth 1–5 m, mangrove scrapings; 8 Aug 2021; K.N. White leg.; USNM 1739780, USNM 1739781.

**Diagnosis.** Head and body with tiny setules. Epistome strongly concave. Pereopod 6 basis posterior margin nearly straight. Pereopod 7 propodus length ~5 × width. Telson apex rounded.

**Distribution.** USA: Panama City to Dry Tortugas, Florida (Lowry and Stoddart 1997; LeCroy 2007); Cuba (Stebbing 1897); Panama: Bocas del Toro (present study).

**Ecology and remarks.** These amphipods are associated with algae and coral rubble at depths of 2–69 m. Panamanian specimens closely resemble previously described specimens and can be readily distinguished from *Shoemakerella lowryi* Gable & Lazo-Wasem, 1990 based on the pereopod 6 basis posterior margin, pereopod 7 propodus length relative to the carpus length, and the telson apex. Panamanian specimens are yellow-orange in color when alive.

### ***Shoemakerella lowryi* Gable & Lazo-Wasem, 1990**

Figs 7, 11B

*Lysianassa punctata* Kunkel, 1910: 8–10, fig. 1; Johnson 1986: 377, fig. 124.  
*Shoemakerella lowryi* Gable & Lazo-Wasem, 1990: 727–733, figs 5–7.

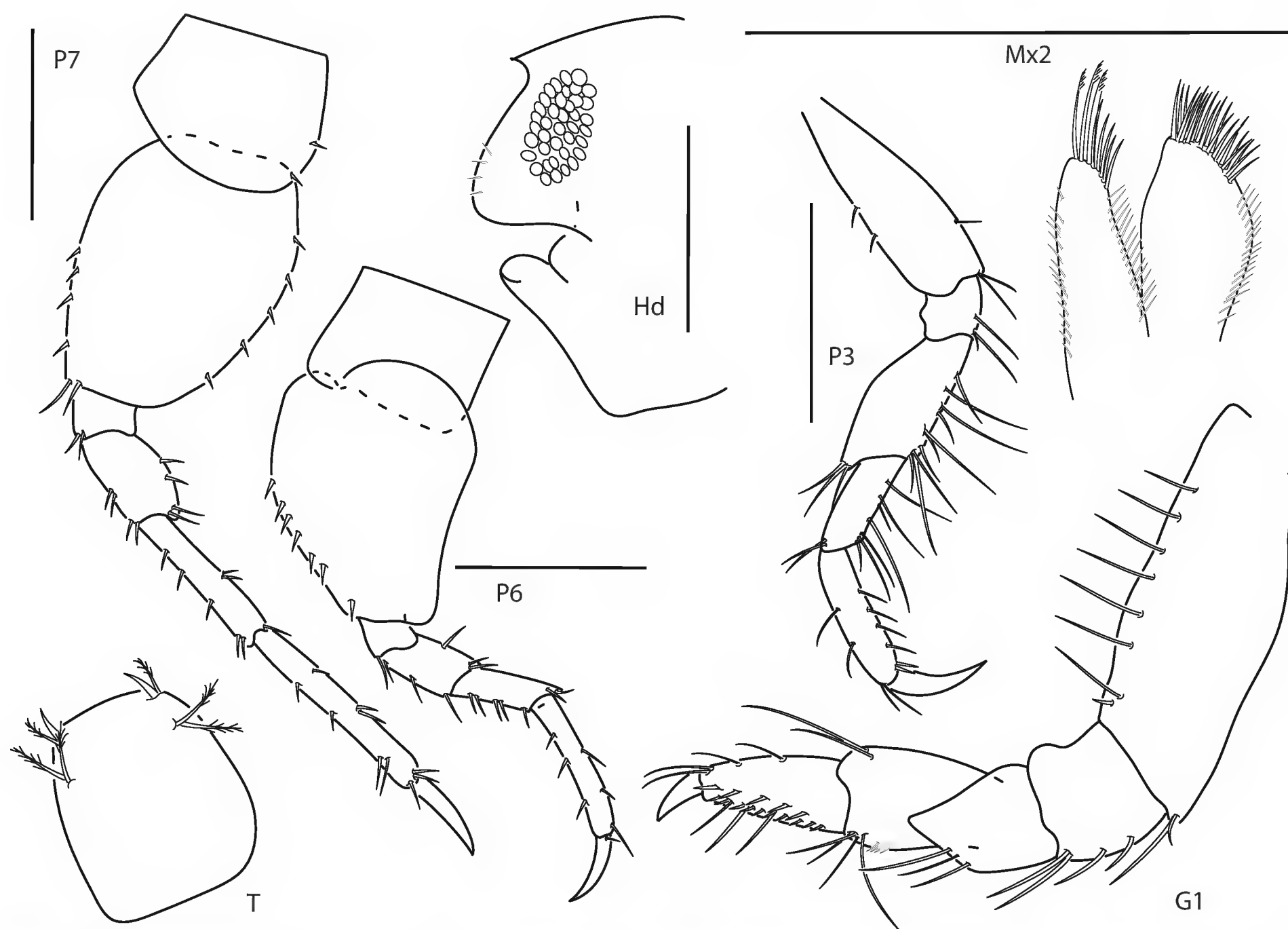
**Material examined.** PANAMA • 2–5.5 mm • 1 ♂; Bocas del Toro, San Cristobal; 9.2625°N, 82.2350°W; depth 15 m, among coral rubble; 10 August 2021; K.N. White leg.; USNM 1739782 • 1 ♀; Bocas del Toro, Swan Cay; 9.4536°N, 82.300033°W; depth 2 m, among sponges; 24 Jun 2023; K.N. White leg.; USNM 1739783 • 2 ♀; Bocas del Toro, Crawl Cay; 9.245967°N, 82.136867°W; depth 1–4 m, among coral rubble; 25 June 2023; K.N. White leg.; USNM 1739784 • 4 ♀; Bocas del Toro, Cayo Zapatilla 1; 9.2700°N, 82.0587°W; depth 10–11 m, among coral rubble; 28 June 2023; K.N. White leg.; USNM 1739785.

**Diagnosis.** Head and body with tiny setules. Epistome weakly concave. Pereopod 6 basis posterior margin slightly concave. Pereopod 7 propodus length ~9 × width. Telson apex truncate.

**Distribution.** Bermuda (Gable and Lazo-Wasem 1990); Panama: Bocas del Toro (present study).

**Ecology and remarks.** These amphipods are associated with algae, seagrass, and coral rubble at depths of 0.5–9 m. Panamanian specimens closely resemble previously described specimens and can be readily distinguished from *Shoemakerella cubensis* based on the pereopod 6 basis posterior margin, pereopod 7 propodus length relative to the carpus length, and the telson apex. Panamanian specimens are transparent white in color with brown spots when alive.





**Figure 7.** *Shoemakerella lowryi*, male, 4.5 mm, pereopod 7, pereopod 6, head, epistome and upper lip, pereopod 3, maxilla 2, telson, gnathopod 1 lateral. Scale bars: 0.5 mm.

## Family Tryphosidae Lowry & Stoddart, 1997

### Genus *Lepidepecreum* Bate & Westwood, 1868

**Diagnosis.** Antenna 1 with strong callynophore in male and weak callynophore in female. Antenna 2 of male elongate. Antenna 2 peduncular article 3 elongate in male and female. Maxilla 2 inner plate narrow. Gnathopod 1 subchelate; coxa large, about as long as coxa 2; carpus long (length 2 to 4 × width). Uropod 2 inner ramus without distinct dorsal notch. Uropod 3 outer ramus 2-articulate. Telson cleft.

### *Lepidepecreum* cf. *magdalenensis* (Shoemaker, 1942)

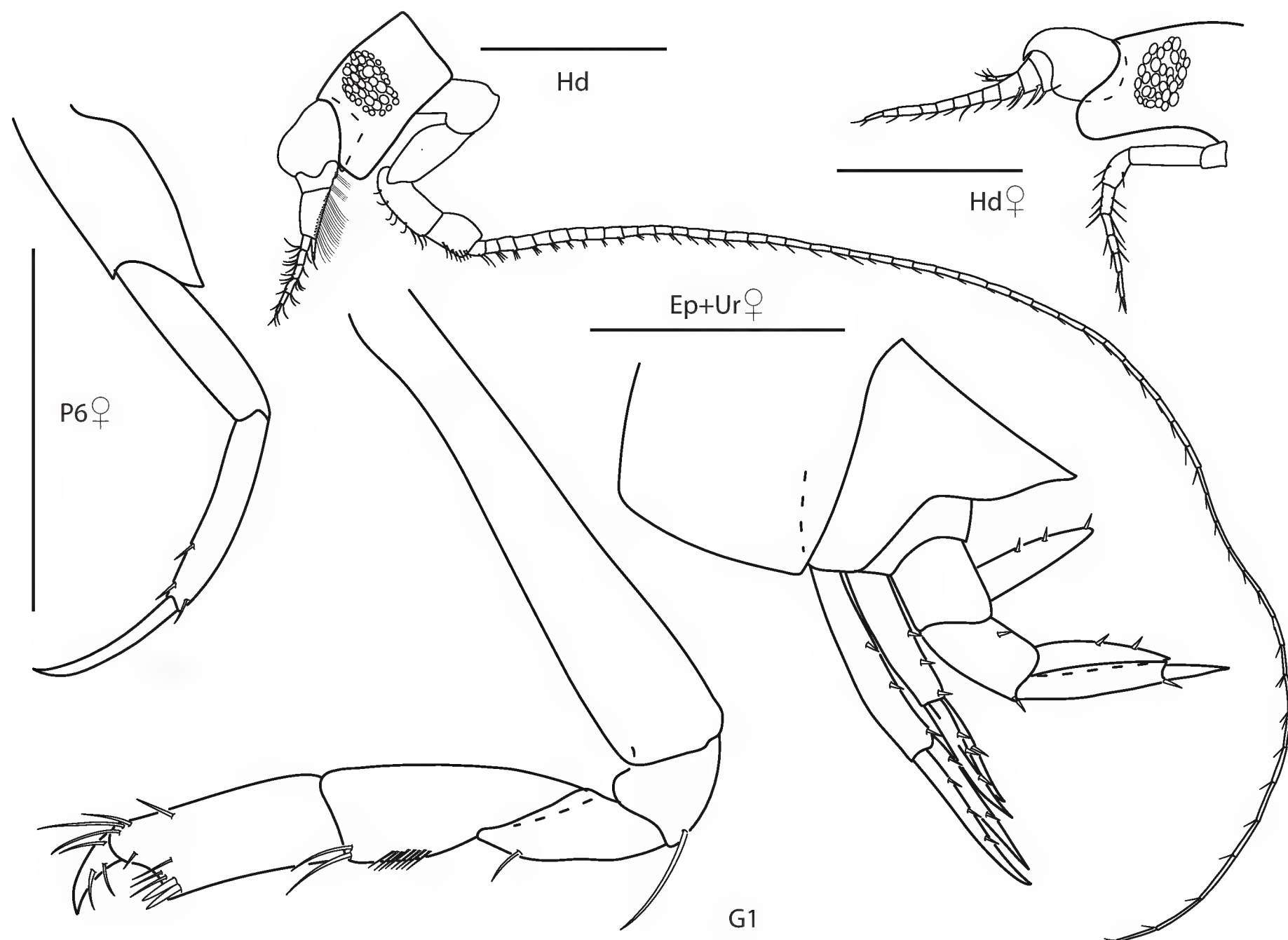
Figs 8, 11C

*Orchomenella magdalenensis* Shoemaker, 1942: 4–7, fig. 1.

*Lepidepecreum magdalenensis* Lowry & Stoddart, 2002: 173–174; LeCroy 2007: 580, fig. 492.

**Material examined.** PANAMA • 2–3 mm • 6 ♂, 16 ♀; Bocas del Toro, Drago Beach; 9.4172°N, 82.3248°W; depth 0–1 m, in sand; 27 June 2023; K.N. White leg.; USNM 1739786.





**Figure 8.** *Lepidepecreum magdalenensis*, female, 3.0 mm, head, epimeron 3 and urosome, pereopod 6; male, 2.8 mm, head, gnathopod 1 lateral. Scale bars: 0.5 mm.

**Diagnosis.** Head ocular lobe subrectangular. Gnathopod 1 carpus as long as propodus. Epimeron 3 posteroventral corner subquadrate. Urosomite 1 with dorsodistally acute carina. Uropod 3 inner ramus with two marginal spines.

**Distribution.** USA: Pacific California (Shoemaker 1942); Florida from Cape Romano to the lower Florida Keys (LeCroy, 2007); Cuba? (Ortiz 1978); Panama: Bocas del Toro (present study).

**Ecology and remarks.** These amphipods are associated with sand at depths of 0.5–27 m. Panamanian specimens closely resemble previously described specimens, except for a weak callynophore in females (strong in original description) and uropod 3 inner ramus having 2 marginal spines (3 in original description). LeCroy (2007) notes that Florida specimens of *L. cf. magdalenensis* have only one spine, suggesting that this may vary among specimens of this genus. The weak callynophore on antenna 1 of females may suggest that *L. magdalenensis* represents a species complex, but this can only be resolved with further examination of all collections. Panamanian specimens are white in color when alive.

### Genus *Orchomenella* Sars, 1890

**Diagnosis.** Antenna 2 of male flagellum elongate. Antenna 2 peduncular article 3 short. Maxilla 2 inner plate narrow. Gnathopod 1 subchelate; carpus short (length less than 2 × width). Uropod 2 inner ramus without distinct dorsal notch. Telson cleft.



***Orchomenella thomasi* Lowry & Stoddart, 1997**

Figs 9, 11D

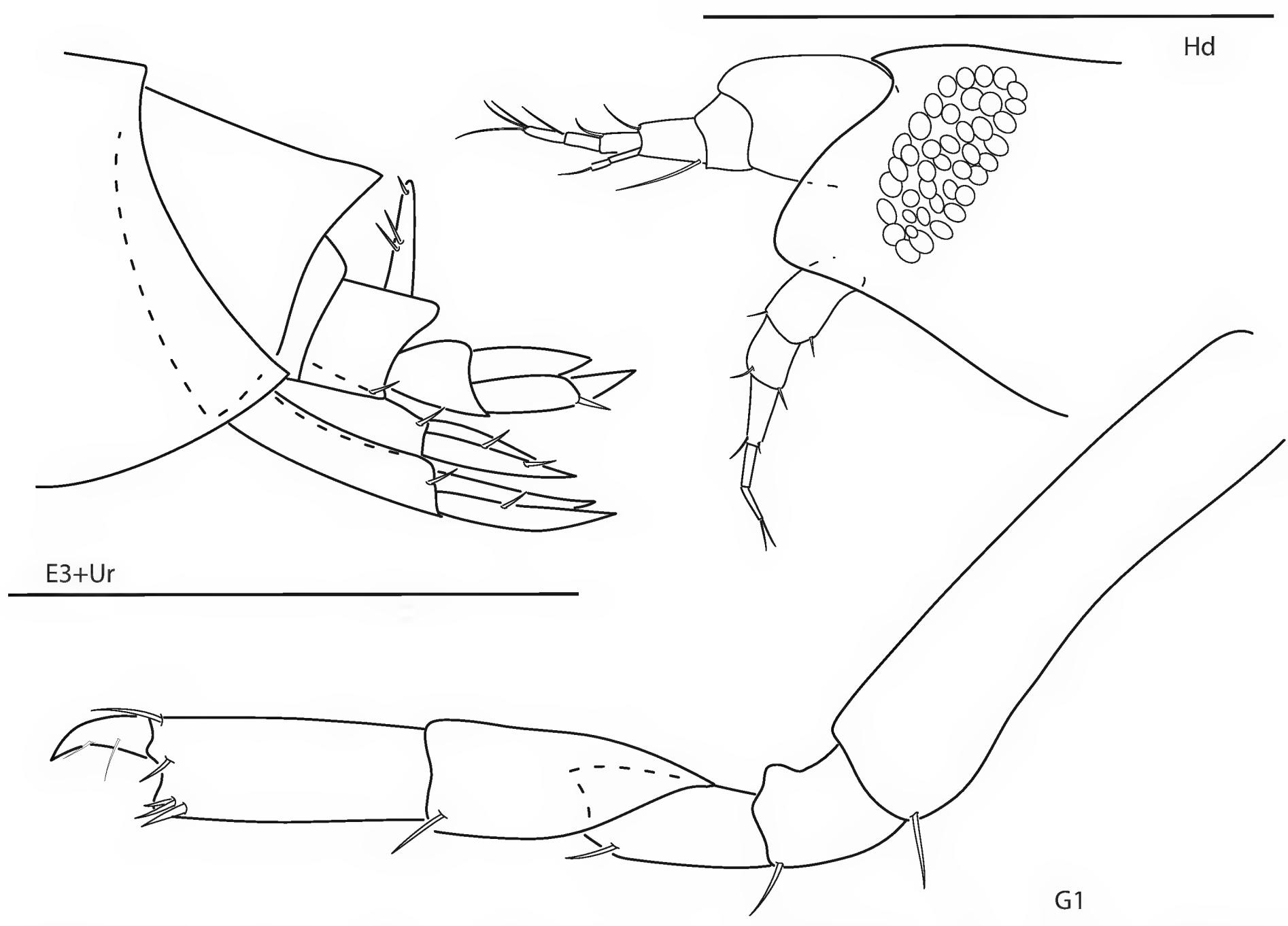
*Orchomenella thomasi* Lowry & Stoddart, 1997: 109–113, figs 52–53; LeCroy 2007: 586, fig. 502.

**Material examined.** PANAMA • 1.5 mm • 1 ♀; Bocas del Toro, Cayo Zapatilla 1; 9.2700°N, 82.0587°W; depth 10–11 m, among coral rubble; 28 June 2023; K.N. White leg.; USNM 1739787.

**Diagnosis.** Head ocular lobe subtriangular. Gnathopod 1 carpus shorter than propodus. Epimeron 3 posteroventral corner acute. Urosomite 1 with dorsodistally acute carina. Uropod 3 inner ramus bare; outer ramus 2-articulate.

**Distribution.** USA: from Sanibel Island, Florida to Louisiana (Lowry and Stoddart 1997; LeCroy 2007); Panama: Bocas del Toro (present study).

**Ecology and remarks.** These amphipods are associated with sand and coral rubble at depths of 10–73 m. Panamanian specimens closely resemble previously described specimens. Panamanian specimens are white in color when alive.



**Figure 9.** *Orchomenella thomasi*, female, 1.5 mm, head, epimeron 3 and urosome, gnathopod 1 lateral. Scale bars: 0.5 mm.



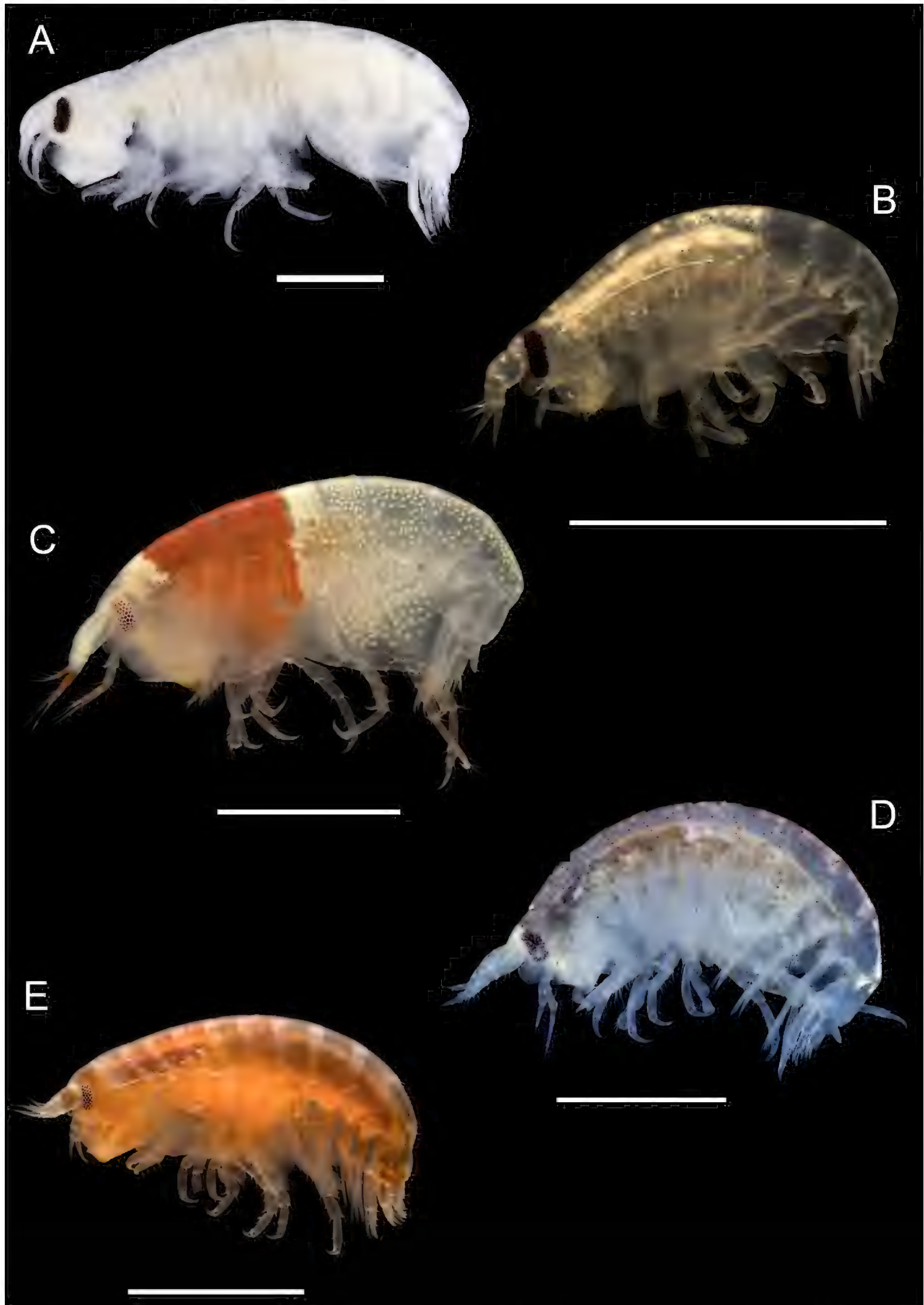
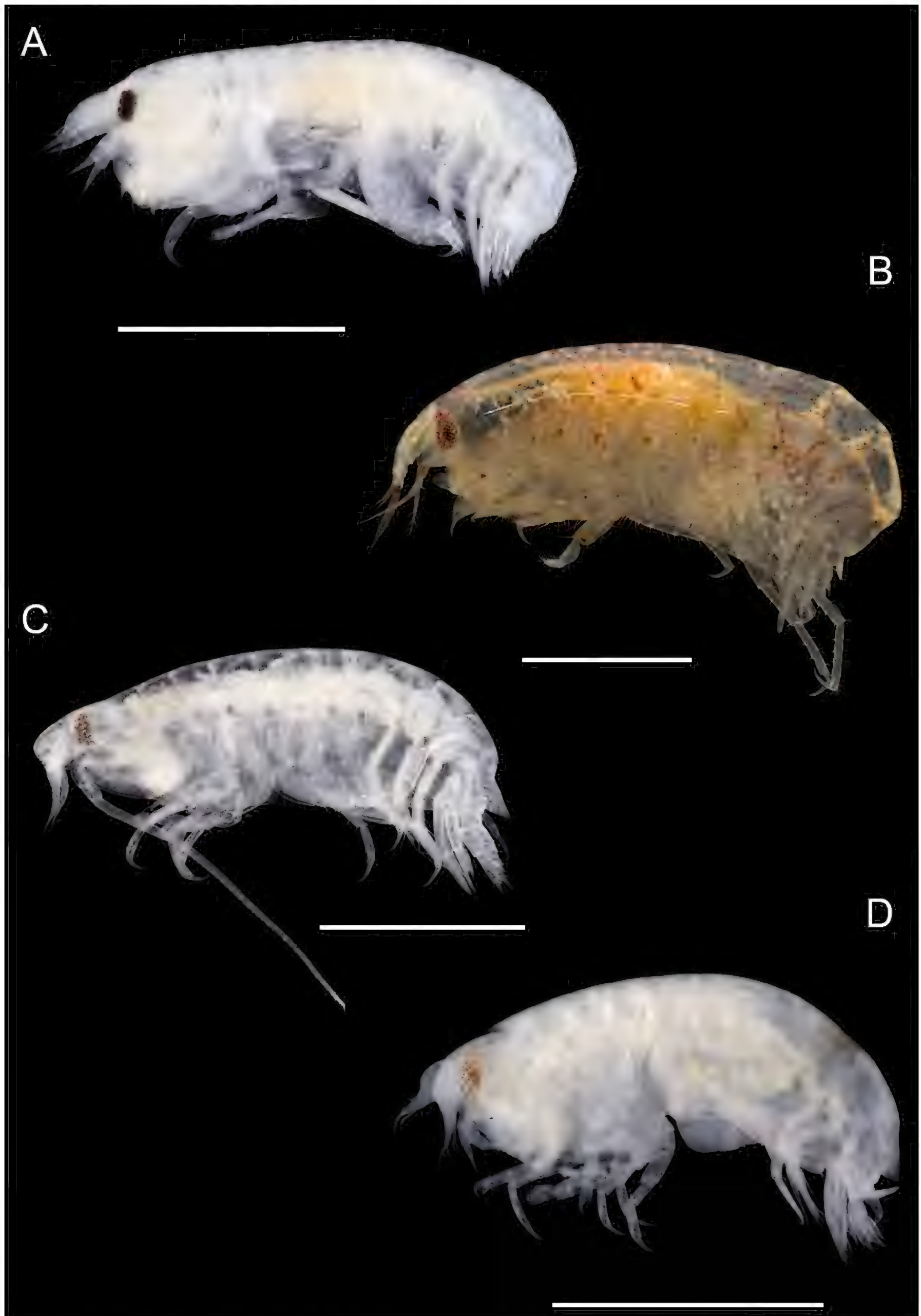


Figure 10. Photographs of live specimens unless noted **A** *Aruga holmesi* (ethanol preserved specimen) **B** *Bonassa bonai-rensensis* **C** *Concarnes concavus* **D** *Lysianopsis hummelincki* **E** *Lysianopsis ozona*. Scale bars: 1.0 mm.





**Figure 11.** Photographs of live specimens unless noted **A** *Shoemakerella cubensis* (ethanol preserved specimen) **B** *Shoemakerella lowryi* **C** *Lepidepecreum magdalenensis* (ethanol preserved specimen) **D** *Orchomenella thomasi* (ethanol preserved specimen). Scale bars: 1.0 mm.



## Identification Key to the Caribbean Lysianassidira of Panama

- 1 Eye absent; pereopod 5 basis narrowly expanded.....2
- Eye present, well developed; pereopod 5 basis broadly expanded.....3
- 2 Head ocular lobe produced; epimeron 3 posteroventral margin with acute tooth; telson deeply cleft, about 75% .....***Paracentromedon carabicus***
- Head ocular lobe evenly rounded; epimeron 3 posteroventral margin rounded; telson shallowly cleft, less than 50%.....***Vemana compressa***
- 3 Gnathopod 1 subchelate; urosomite 1 with dorsodistally acute carina; uropod 2 inner ramus without distinct dorsal notch (Figs 8, 9).....4
- Gnathopod 1 simple; urosomite 1 without dorsodistal carina; uropod 2 inner ramus with distinct dorsal notch (Fig. 1).....5
- 4 Antenna 2 peduncle article 3 long in female; head ocular lobe subrectangular; gnathopod 1 carpus as long as propodus; epimeron 3 posteroventral corner subquadrate; uropod 3 inner ramus with marginal spines (Fig. 8) .....***Lepidepecreum magdalenensis***
- Antenna 2 peduncle article 3 short in female; head ocular lobe subtriangular; gnathopod 1 carpus shorter than propodus; epimeron 3 posteroventral corner acute; uropod 3 inner ramus bare (Fig. 9).....***Orchomenella thomasi***
- 5 Gnathopod 1 dactylus reduced, complex, covered in long, slender cuticular teeth; telson entire .....***Eclecticus eclecticus***
- Gnathopod 1 dactylus not reduced, simple; telson entire or partially cleft. ....6
- 6 Gnathopod 2 minutely subchelate; telson partially cleft (Fig. 3).....***Concarnes concavus***
- Gnathopod 2 minutely chelate (Figs 5, 6); telson entire (Figs 1, 6).....7
- 7 Maxilla 2 inner plate wider than outer plate (Fig. 7); uropod 2 abruptly narrowing at notch (Fig. 6) .....8
- Maxilla 2 inner plate narrow, similar in width to outer plate (Fig. 5); uropod 2 gradually narrowing at notch (Fig. 1) .....9
- 8 Pereopod 6 basis posterior margin nearly straight; pereopod 7 propodus length ~5 × width; telson apex rounded (Fig. 6)..... ***Shoemakerella cubensis***
- Pereopod 6 basis posterior margin slightly concave; pereopod 7 propodus length ~9 × width; telson apex truncate (Fig. 7).....***Shoemakerella lowryi***
- 9 Epistome rounded; uropod 3 outer ramus 1-articulate (Fig. 2) .....10
- Epistome concave; uropod 3 outer ramus 2-articulate (Fig. 1) .....11
- 10 Epistome produced, subequal to produced upper lip; gnathopod 1 basis slender; pereopod 7 basis greatly expanded, posteriorly rounded, merus greatly expanded, approximately 3 × width of carpus (Fig. 2)....***Bonassa bonairensis***
- Epistome not produced, upper lip produced; gnathopod 1 basis stout; pereopod 7 basis slightly expanded, posterior margin almost straight, merus slightly expanded, approximately 1.4 × width of carpus (Fig. 4) .....***Lysianopsis hummelincki***
- 11 Upper lip projecting well beyond epistome; gnathopod 1 propodus posterodistal margin slightly concave; uropod 3 peduncle long, length at least 2 × width; telson apical margin slightly emarginate (Fig. 1) .....***Aruga holmesi***
- Upper lip subequal to epistome; gnathopod 1 propodus posterodistal margin straight; uropod 3 peduncle short, length approximately 1.5 × width; telson apical margin slightly truncate (Fig. 5) ..... ***Lysianopsis ozona***



## Discussion

The results of this study represent range extensions for eight species of lysianassid amphipods to include the Caribbean waters of Panama. One species collected in this study, *Concarnes concavus*, has been recorded from the Caribbean of Panama by Miloslavich et al. (2010), yet those authors did not provide any specific locality information, so it is unclear what the exact range of this species is in the Caribbean waters of Panama. Two species documented here have a distribution pattern spanning the eastern Pacific and western Caribbean (*Aruga holmesi* and *Lepidepecreum magdalenensis*). These distribution patterns may suggest that the species were established more than 3 mya, before the isthmus of Panama closed, or that we have species complexes that need to be investigated further.

Characters that have been used to identify lysianassid amphipods in the past, such as setae patterns on the dorsal surface of the body appear to be variable in Panamanian specimens and should not be used for identification. Sexual dimorphism is also used frequently but can be problematic when you have only one specimen or gender. Mouthparts are also often used as diagnostic characters which can be difficult for non-experts; thus, I included as many other characters as possible in this identification key.

## Acknowledgements

Logistical support and facilities were provided by Georgia College & State University Department of Biological and Environmental Sciences and the Smithsonian Tropical Research Institute (STRI). Special thanks to Carolina Cesar and Valentina Cardona for assistance with diving and collecting in Bocas del Toro. The author also wishes to thank Dr Lauren Hughes and the Amphipod Taxonomy Course members for collecting assistance in 2023. Special thanks go to Sara LeCroy for her loan of specimens collected in 2005 and to Sally Sir, Sara LeCroy, and Tammy Horton for suggestions to improve the manuscript.

## Additional information

### Conflict of interest

The authors have declared that no competing interests exist.

### Ethical statement

No ethical statement was reported.

### Funding

Funding for this study was provided by a National Science Foundation grant: Collaborative Research: ARTS: Understanding Tropical Invertebrate Diversity Through Integrative Revisionary Systematics and Training (1856421).

### Author contributions

Conceptualization: KNW. Data curation: KNW. Formal analysis: KNW. Funding acquisition: KNW. Investigation: KNW. Methodology: KNW. Project administration: KNW. Writing - original draft: KNW. Writing - review and editing: KNW.



## Author ORCIDs

Kristine N. White  <https://orcid.org/0000-0002-5203-1656>

## Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

## References

- Andres HG (1977) Gammaridea (Crustacea, Amphipoda) aus dem Iberischen Tiefseebecken Auswertung des materials der Fahrten 3 und 15 von F. S. Meteor. Meteor Forschungsergebnisse (Reihe D) 25: 54–67.
- Austin WC (1985) An Annotated Checklist of Marine Invertebrates in the Cold Temperate Northeast Pacific. Cowichan, B.C., Khoyatan Marine Laboratory, 682 pp.
- Barnard JL (1955) Notes on the amphipod genus *Aruga* with the description of a new species. Bulletin of the Southern California Academy of Sciences 54(2): 97–103.
- Barnard JL (1958) Index to the families, genera, and species of the gammaridean Amphipoda (Crustacea). Allan Hancock Foundation Publications, Occasional Paper 19: 1–145.
- Barnard JL (1959) Estuarine Amphipoda. Allan Hancock Foundation Publications, Occasional Paper 21: 13–9.
- Barnard JL (1961) Gammaridean Amphipoda from depths of 400 to 6000 meters. Galathea Report 5: 23–128.
- Barnard JL (1964) Deep-sea Amphipoda (Crustacea) collected by the R/V “Vema” in the eastern Pacific Ocean and the Caribbean and Mediterranean seas. Bulletin of the American Museum of Natural History 127(1): 1–46.
- Barnard JL (1966a) Benthic Amphipoda of Monterey Bay, California. Proceedings of the United States National Museum 119: 1–41. <https://doi.org/10.5479/si.00963801.119-3541.1>
- Barnard JL (1966b) Submarine canyons of southern California. Part V. Systematics: Amphipoda. Allan Hancock Pacific Expeditions 27(5): 1–166.
- Barnard JL (1969) Gammaridean Amphipoda of the rocky intertidal of California: Monterey Bay to La Jolla. United States National Museum Bulletin 258: 1–230. <https://doi.org/10.5479/si.03629236.258.1>
- Barnard JL (1979) Littoral gammaridean Amphipoda from the Gulf of California and the Galapagos Islands. Smithsonian Contributions to Zoology 271: 1–149. <https://doi.org/10.5479/si.00810282.271>
- Barnard JL, Karaman GS (1991) The families and genera of marine gammaridean Amphipoda (Except marine Gammaroidea). Records of the Australian Museum Supplement 13 (Part 2): 419–866. <https://doi.org/10.3853/j.0812-7387.13.1991.367>
- Bate CS, Westwood JO (1868) A History of the British sessile-eyed Crustacea. Vol. 11. John Van Voorst, London, 401–536.
- Coleman CO (2003) “Digital inking”: how to make perfect line drawings on computers. Organisms Diversity & Evolution 3(14): 1–14. <https://doi.org/10.1078/1439-6092-00081>
- Dana JD (1849) Synopsis of the genera of Gammaracea. American Journal of Science and Arts, Series 2, 8: 135–140.
- Dana JD (1852) On the classification of the Crustacea Choristopoda or Tetracapoda. The American Journal of Science and Arts, Second Series 14(41): 297–316.



- Gable MF, Lazo-Wasem EA (1990) Lysianassidae (Amphipoda: Lysianassoidea) of Bermuda. *Journal of Crustacean Biology* 10(4): 721–734. <https://doi.org/10.2307/1548416>
- Gurjanova EF (1962) Amphipoda of the northern part of the Pacific Ocean (Amphipoda-Gammaridea). Part 1. *Akademiya Nauk SSSR, Opredeliteli po Faune SSSR* 74: 1–440.
- Holmes SJ (1903) Synopses of North-American invertebrates. XVIII. The Amphipoda. *American Naturalist* 37: 267–292. <https://doi.org/10.1086/278286>
- Holmes SJ (1908) The Amphipoda collected by the U.S. Bureau of Fisheries steamer Albatross off the west coast of North America, in 1903 and 1904, with descriptions of a new family and several new genera and species. *Proceedings of the United States National Museum* 35: 489–543. <https://doi.org/10.5479/si.00963801.35-1654.489>
- Horton T, Lowry J, De Broyer C, Bellan-Santini D, Copilaş-Ciocianu D, Corbari L, Costello MJ, Daneliya M, Dauvin J-C, Fišer C, Gasca R, Grabowski M, Guerra-García JM, Hendrycks E, Hughes L, Jaume D, Jazdzewski K, Kim Y-H, King R, Krapp-Schickel T, LeCroy S, Lörz A-N, Mamos T, Senna AR, Serejo C, Souza-Filho JF, Tandberg AH, Thomas JD, Thurston M, Vader W, Väinölä R, Valls Domedel G, Vonk R, White K, Zeidle, W (2024) World Amphipoda Database. [on 2024-07-05] <https://doi.org/10.14284/368>
- Hurley DE (1963) Amphipoda of the family Lysianassidae from the west coast of North and Central America. *Allan Hancock Foundation Publications, Occasional Paper* 25: 1–160.
- Johnson SE (1986) Order Amphipoda. In: Sterrer W (Ed.) *Marine Fauna and Flora of Bermuda*. John Wiley & Sons, New York, 372–381.
- Kunkel BW (1910) The Amphipoda of Bermuda. *Transactions of the Connecticut Academy of Arts and Sciences* 16: 1–116.
- Lalana Rueda R, Ortiz M (1990) Zoobentos de Cayo Hicacos, SE de la Isla de la Juventud, Cuba. *Revista de Investigaciones Marinas* 11(3): 191–199.
- Lalana Rueda R, Pérez Moreno M (1985) Estudio cualitativo y cuantitativo de la fauna asociada a las raíces de *Rhizophora mangle* en la cayería este de la Isla de la Juventud. *Revista Investigaciones Marinas* 6(2–3): 45–57.
- Lalana Rueda R, Capetillo R, Brito E, Diaz E, Cruz R (1989) Estudio del zoobentos asociado a *Laurencia intricata* en un área de juveniles de langosta, al SE de la Isla de la Juventud, Cuba. *Revista Investigaciones Marinas* 10(3): 207–218.
- LeCroy SE (2007) An Illustrated Identification Guide to the Nearshore Marine and Estuarine Gammaridean Amphipoda of Florida Volume 4: Families Anamixidae, Eusiridae, Hyalellidae, Hyalidae, Iphimediidae, Ischyroceridae, Lysianassidae, Megaluropidae, and Melphidippidae. *Florida Department of Environmental Protection Annual Report Contract No. WM724* 1: 1–195.
- LeCroy SE, Gasca R, Winfield I, Ortiz M, Escobar-Briones E (2009) Amphipoda (Crustacea) of the Gulf of Mexico. In: Felder DL, Camp DK (Eds) *Gulf of Mexico: Origin, Waters, and Biota*. Texas A&M University Press, Texas, 941–972.
- Lilljeborg W (1865) Bidrag till kannedomen om underfamiljen Lysianassina inom underordningen Amphipoda bland kraftdjuren. *Nova Acta Regiae Societatis Scientiarum Upsaliensis* 3: 1–25.
- Lowry JK, DeBroyer (2008) Alicellidae and Valettiopsidae, two new callynophorate families (Crustacea, Amphipoda). *Zootaxa* 1843: 57–66. <https://doi.org/10.11646/zootaxa.1843.1.5>
- Lowry JK, Myers AA (2017) A Phylogeny and Classification of the Amphipoda with the establishment of the new order Ingolfiellida (Crustacea: Peracarida). *Zootaxa* 4265(1): 1–89. <https://doi.org/10.11646/zootaxa.4265.1.1>



- Lowry JK, Stoddart HE (1989) *Shoemakerella* Pirlot, 1936 (Crustacea, Amphipoda): proposed designation of *Lysianax cubensis* Stebbing, 1897, as type species. Bulletin of Zoological Nomenclature 46(4): 236–238. <https://doi.org/10.5962/bhl.part.550>
- Lowry JK, Stoddart HE (1990) The Wandinidae, a new indo-pacific family of Lysianassoid Amphipoda (Crustacea). Records of the Australian Museum 42: 159–171. <https://doi.org/10.3853/j.0067-1975.42.1990.113>
- Lowry JK, Stoddart HE (1995) The Amphipoda (Crustacea) of Madang Lagoon: Lysianassidae, Opisidae, Uristidae, Wandinidae and Stegocephalidae. In: Lowry JK (Ed.) Amphipoda (Crustacea) of the Madang Lagoon, Papua New Guinea. Records of the Australian Museum, Supplement 22: 97–174. <https://doi.org/10.3853/j.0812-7387.22.1995.122>
- Lowry JK, Stoddart HE (1996) New lysianassoid amphipod species from Namibia and Madagascar (Lysianassidae Dana, 1849 and Podoprionidae fam. nov.). Bolletino del Museo Civico di Storia Naturale di Verona. 20(1): 225–247.
- Lowry JK, Stoddart HE (1997) Amphipoda Crustacea IV. Families Aristiidae, Cyphocarididae, Endeavouridae, Lysianassidae, Scopelocheiridae, Uristidae. Memoirs of the Hourglass Cruises 10: 1–148.
- Lowry JK, Stoddart HE (2002) The Amaryllididae of Australia (Crustacea: Amphipoda: Lysianassoidea). Records of the Australian Museum 54(2): 129–214. <https://doi.org/10.3853/j.0067-1975.54.2002.1363>
- Lowry JK, Stoddart HE (2010a) The deep-sea scavenging genus *Hirondellea* (Crustacea: Amphipoda: Lysianassoidea: Hirondelleidae fam. nov.) in Australian waters. Zootaxa 2329: 37–55. <https://doi.org/10.11646/zootaxa.2329.1.3>
- Lowry JK, Stoddart HE (2010b) Sophrosynidae, a new family in the Lysianassoidea (Crustacea: Amphipoda) with a revision of the genus *Sophrosyne*. Zootaxa 2370(1): 1–35. <https://doi.org/10.11646/zootaxa.2370.1.1>
- Lowry JK, Stoddart HE (2010c) The family Izinkalidae fam. nov. (Crustacea: Amphipoda: Lysianassoidea) in Australian waters. Zootaxa 2532(1): 64–68. <https://doi.org/10.11646/zootaxa.2532.1.3>
- Lowry JK, Stoddart HE (2010d) Kergueleniidae fam. nov. (Crustacea: Amphipoda: Lysianassoidea) in Australian waters. Zootaxa 2564(1): 1–30. <https://doi.org/10.11646/zootaxa.2564.1.1>
- Lowry JK, Stoddart HE (2011) The new deep-sea families Cebocaridae fam. nov., Cyclocaridae fam. nov. and Thoriellidae fam. nov. (Crustacea: Amphipoda: Lysianassoidea). Zootaxa 2747: 53–68. <https://doi.org/10.11646/zootaxa.2747.1.4>
- Lowry JK, Stoddart HE (2012) Australian and South African conicostomatine amphipods (Amphipoda: Lysianassoidea: Lysianassidae: Conicostomatinae subfam. nov.). Zootaxa 3248: 43–65. <https://doi.org/10.11646/zootaxa.3248.1.4>
- Martín A, Díaz Y, Miloslavich P, Escobar-Briones E, Guerra-García JM, Ortiz M, Valencia B, Giraldo A, Klein E (2013) Regional diversity of Amphipoda in the Caribbean Sea. Revista de Biología Tropical 61(4): 1681–1720. <https://doi.org/10.15517/rbt.v61i4.12816>
- Miloslavich P, Díaz JM, Klein E, Alvarado JJ, Díaz C, Gobin J, Escobar-briones E, Cruz-motta JJ, Weil E, Cortés J, Bastidas AC, Robertson R, Zapata F, Martín A, Castillo J, Kazandjian A, Ortiz M (2010) Marine biodiversity in the Caribbean: regional estimates and distribution patterns. PLoS ONE 5(8): e11916. <https://doi.org/10.1371/journal.pone.0011916>
- Ortiz M (1978) Invertebrados marinos bentosicos de Cuba. I. Crustacea, Amphipoda, Gammaridea. Ciencias 38: 3–10.



- Ortiz M (1979) Lista de especies y bibliografía de los anfípodos (Crustacea: Amphipoda) del Mediterráneo Americano. Ciencias (La Habana), Series 8, Investigaciones Marinas 43: 1–40.
- Ortiz M, Lalana Rueda R (1992) Parasites de anfípodos (Gammaridea) de Cuba. Revista Investigaciones Marinas 13(1): 39–48.
- Ortiz M, Lalana Rueda R (1993) Adición a la lista de especies y bibliografía de los anfípodos (Crustacea: Amphipoda) del Mediterráneo Americano. Revista Investigaciones Marinas 14(1): 16–37.
- Ortiz M, Lemaitre R (1994) Crustaceos Anfipodos (Gammaridea) Colectados en Las Costas del Caribe Colombiano, al sur de Cartagena. Anales del Instituto de Investigaciones Marinas de Punta de Betin 23: 119–127.
- Pearse AS (1912) Notes on certain amphipods from the Gulf of Mexico, with descriptions of new genera and new species. Proceedings of the United States National Museum 43: 369–379. <https://doi.org/10.5479/si.00963801.43-1936.369>
- Pirlot JM (1936) Les amphipodes de l'expédition du Siboga. Deuxième partie: Les amphipodes gammarides, II. - Les amphipodes de la mer profonde. 3: Addendum et partie générale. III. - Les amphipodes littoraux. 1: Lysianassidae, Ampeliscidae, Leucothoidae, Stenothoidae, Phliantidae, Colomastigidae, Ochlesidae, Liljeborgiidae, Oedicerotidae, Synopiidae, Eusiridae, Gammaridae. Siboga-Expeditie, Monographie 33e: 237–328.
- Pirlot JM (1939) Amphipoda. Résultats scientifiques des croisières du navire-école Belge 'Mercator'. Mémoires du Musée Royal d'Histoire Naturelle de Belgique, Series 2, 15: 47–80.
- Sars GO (1890) An Account of the Crustacea of Norway, with Short Descriptions and Figures of all the Species. Vol. I. Amphipoda. Parts 1–3. Christiana, Alb. Cammermeyer, 68 pp.
- Shoemaker CR (1921) Report on the amphipods collected by the Barbados-Antigua Expedition from the University of Iowa in 1918. University of Iowa Studies in Natural History 9(5): 99–102.
- Shoemaker CR (1933) Amphipoda from Florida and the West Indies. American Museum Novitates 598: 1–24.
- Shoemaker CR (1935) The amphipods of Porto Rico and the Virgin Islands. Scientific Survey of Porto Rico and the Virgin Islands (New York Academy of Sciences) 15: 229–253.
- Shoemaker CR (1942) Amphipod crustaceans collected on the Presidential Cruise of 1938. Smithsonian Miscellaneous Collections 101(11): 1–52.
- Shoemaker CR (1948) The Amphipoda of the Smithsonian-Roebling Expedition to Cuba in 1937. Smithsonian Miscellaneous Collections 110(3): 1–15. <https://doi.org/10.5962/bhl.part.9028>
- Stebbing TRR (1888) Report on the Amphipoda collected by H.M.S. Challenger during the years 1873–1876. Zoology 29: 1–1737.
- Stebbing TRR (1897) Amphipoda from the Copenhagen Museum and other sources. Transactions of the Linnean Society, London, Series 2, Zoology 7: 25–45 [pls 6–14]. <https://doi.org/10.1111/j.1096-3642.1897.tb00400.x>
- Stebbing TRR (1906) Amphipoda I. Gammaridea. Das Tierreich 21: 1–806.
- Stephensen K (1933a) Zoologische Ergebnisse einer Reise nach Bonaire, Curaçao und Aruba im Jahre 1930. No. 8. Fresh- and brackish-water Amphipoda from Bonaire, Curaçao and Aruba. Zoologische Jahrbucher. Abteilung für Systematik, Ökologie und Geographie der Tiere 64(3/5): 415–436.



- Stephensen K (1933b) Zoologische Ergebnisse einer Reise nach Bonaire, Curaçao und Aruba im Jahre 1930. No. 9. Amphipoda from the marine salines of Bonaire and Curaçao. Zoologische Jahrbucher. Abteilung für Systematik, Ökologie und Geographie der Tiere 64(3/5): 437–446.
- Stephensen K (1948) Amphipods from Curaçao, Bonaire, Aruba and Margarita. Studies on the Fauna of Curaçao, Aruba, Bonaire and the Venezuelan Islands 3(11): 1–20.
- Stepien CA, Brusca RC (1985) Nocturnal attacks on nearshore fishes in southern California by crustacean zooplankton. Marine Ecology Progress Series 25: 91–105. <https://doi.org/10.3354/meps025091>
- Stoddart HE, Lowry JK (2004) The deep-sea lysianassoid genus *Eurythenes* (Crustacea, Amphipoda, Eurytheneidae n. fam.). Zoosystema 26(3): 425–468.
- Stoddart HE, Lowry JK (2010) Lepidepcrellidae fam. nov. (Crustacea: Amphipoda: Lysianassoidea) in Australian waters. Zootaxa 2634: 63–68. <https://doi.org/10.11646/zootaxa.2634.1.5>
- Stoddart HE, Lowry JK (2012) Revision of the lysianassoid genera *Acidostoma* and *Shackletonia* (Crustacea: Amphipoda: Acidostomatidae fam. nov.). Zootaxa 3307: 1–34. <https://doi.org/10.11646/zootaxa.3307.1.1>
- Stretch JJ (1985) Quantitative sampling of demersal zooplankton: reentry and airlift dredge sample comparisons. Journal of Experimental Marine Biology and Ecology 91: 125–136. [https://doi.org/10.1016/0022-0981\(85\)90225-4](https://doi.org/10.1016/0022-0981(85)90225-4)
- Thomas JD (1993) Identification manual for marine Amphipoda (Gammaridea): I. Common coral reef and rocky bottom amphipods of South Florida. Florida Department of Environmental Protection Final Report Contract No. SP290: 1–83.

## Supplementary material 1

### Locality table

Author: Kristine N. White

Data type: xlsx

Copyright notice: This dataset is made available under the Open Database License (<http://opendatacommons.org/licenses/odbl/1.0/>). The Open Database License (ODbL) is a license agreement intended to allow users to freely share, modify, and use this Dataset while maintaining this same freedom for others, provided that the original source and author(s) are credited.

Link: <https://doi.org/10.3897/zookeys.1216.135258.suppl1>